Fungicide Efficacy for Sclerotinia Head Rot Control on Sunflower

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OBJECTIVES

Evaluate the efficacy of fungicides for the control of Sclerotinia head rot in confection type sunflower.

INTRODUCTION

Sunflowers (*Helianthus annuus* L.) are an integral part of rotations in the plains region of the United States. Sunflowers fit very well in rotations with small grains and cool season crops and are one of only a few crops that can root deep, use excessive soil water, and recycle nitrogen from deep in the root zone. Unfortunately sunflowers fit rotations with crops susceptible to white mold disease. White mold can affect sunflowers in several ways. Head rot is the most economically devastating of the modes of infection. Severe yield losses from the disease have growers scrambling for any control measures. Breeding for resistance is in its infancy and alternative measures will likely be needed short term to keep the industry viable through years when environments create white mold epidemics. *Sclerotinia sclerotiorum* over winters as sclerotia formed in the seed head. These sclerotia contaminate the harvested sunflower and are nearly impossible to remove with seed cleaning equipment. Confection type sunflowers suffer the greatest economic loss. This project is part of an initial effort to find some means of reducing these losses.

MATERIALS AND METHODS

A site was top dressed with 23 kg/Ha N (28-0-0) on 27 April and cultivated for seedbed preparation before planting with a double disk drill (0.77 meter row spacing) on 19 May. Prior to planting, sclerotia were hand spread on the area adjacent to the trial border and incorporated to improve chance of disease infection. The site, previously fallowed with a late summer planted soybean cover crop and soil type Svea-Barnes complex, was located on the Langdon Research Extension Center. The study was arranged in a randomized complete block design with four replicates. The seed was confection type Interstate 8048 and was selected as having some tolerance to head rot caused by *Sclerotinia sclerotiorum* based on data from 2004 variety trials at the Langdon Research Extension Center. Planted plot area was two rows spaced 0.77 meter wide and 3.7 meters long. Approximately 14.4 grams of seeds were planted per plot. An application of Prowl H_20 herbicide at 3.5 liters per hectare was applied with a tractor type sprayer on 23 May as a pre-emerge application for broadleaf weed control. On 4 June 0.33 liter per hectare of Select + 1% v/v crop oil was applied to control grass type weeds. All remaining weeds were controlled by one between-row tillage when the sunflowers were 30 cm tall and hand weeding throughout the season. When the plants reached 15 to 30 cm tall, the stand was hand thinned to about three plants per meter. A 1.5 meter wide alley was cut off each end of the plot with rototiller to reduce

plot size to 3 linear meters. A mist type irrigation system was placed in the center of each alley. Water was applied and timed to deliver a mist for 30 to 60 seconds, twice per hour, to selectively extend the normal nightly wet period both morning and evening to enhance development of disease. Additionally, 7.4 ml of solution (5,000 and 10,000 ascospores per ml) were sprayed on each head on 8 and 16 August, respectively. The 8 August was applied to all heads in the plot although some of the heads had not initiated flowering. Fungicide treatments were applied with backpack sprayer at 172 liter per hectare and 276 kPa with XR8001 nozzles oriented downward. Each treatment was applied twice at half rate traveling both directions to maximize coverage of the sunflower heads. Depending on the treatment, one or two fungicide applications were made. Fungicide was applied from 8:30 to 9:30 a.m. on 8 August and 9:00 to 9:50 a.m. on 20 August. Wind speed was NW at 13 and W at 9.6 km per hour and temperatures were 25.6° C and 15.6° C respectively. Temperatures were warm during flowering and flower duration was limited to a few days. Average growth stage at application time was mid flowering but the range varied from nearly completed to not flowering. North Dakota State University Extension recommended production practices for Northeast North Dakota were followed. Each head in the plot was assessed for incidence (number of heads infected) and severity (scale of 0-5, 0=no infection, 1=0-12.4%, 2=12.5-25%, 3=25-50%, 4=50-99%, 5=100%). Plots were harvested as soon as heads were dry enough to thresh by hand clip and thresh with a Hege plot combine. Due to bird damage a visual estimate of approximate yield reduction was made on a per head basis and an adjusted yield determined to reflect these results. Two hundred seed weights were also determined. Data were analyzed with the general linear model (GLM) in SAS. Least significant differences (LSD) were used to compare means at the 5% probability level.

RESULTS AND DISCUSSION

Precipitation was excessive in June. Greater than 7 inches were recorded at the Research Center for the month. The sunflower flowering period was warm and plants completed flowering in a very short time. Infection levels exceeded expectations and overwhelmed fungicide applications. No differences were found in the mean incidence or severity of the study. Yields are presented as a plot yield and an adjusted yield. The adjusted yield was adjusted for bird damage on an individual head basis. Yield and seed weights were not significantly different due to any treatment. Future studies will require lower levels of spore inoculations (fewer spores/ml) to obtain acceptable infection levels and a sunflower cultivar or line much more tolerant to *Sclerotinia sclerotiorum.*

Note: An adjacent study evaluating lines of sunflowers for resistance to head rot had lower levels of infection. The time of inoculation was different due to a flowering period later in the season. This confection cultivar had much greater levels of infection in the adjacent study than many of the other tested lines.

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Table 1. Sunflower Yield and 200 Seed Weight by Fungicide and Adjuvant Rate and Application Timing Langdon, 2005.

Fungicide and Adjuvants	(rate/acre) or (% v/v)	Application Timing	Cooperator	Trt. (#)	Plot Yield (G)	Adjusted[y] Yield (Lbs/a)	200 Seed Weight (G)
Untreated				1	64.1	184.8	25.3
Endura+Interlock+AGF40023	3 fl oz + 2 fl oz + 2 qt		Agriliance	4	250.5	676.0	26.2
Endura+Interlock+Preference	3 fl oz + 2 fl oz + 0.125 %		Agriliance	5	222.5	680.7	28.3
Endura+Interlock+Preference	3 fl oz + 2 fl oz + 0.25%		Agriliance	19	58.0	141.8	24.8
Endura+Interlock+AG4050	3 fl oz + 2 fl oz + 8 fl oz		Agriliance	20	133.7	342.9	27.9
Endura[z]	4.5 oz + 4.5 oz	+ 12 Days	BASF	13	84.7	229.7	27.4
Endura	6.0 oz + 6.0 ox	+ 12 Days	BASF	14	179.5	436.0	26.3
Endura	9.0 oz + 9.0 oz	+ 12 Days	BASF	15	201.7	581.2	30.1
Endura continuous coverage	4.5 oz + 4.5 oz.	+ 12 Days	BASF	16	157.4	439.0	29.0
Proline 250 EC + NIS	4.3 fl oz + 0.125 %		Bayer	2	117.4	356.7	28.8
Proline 250 EC + NIS	5.7 fl oz + 0.125 %		Bayer	3	86.4	239.8	29.9
Prosaro 421 SC+ NIS	6.5 fl oz + 0.125 %		Bayer	17	230.7	551.0	29.5
Folicur 3.6 F + NIS	6 fl oz + 0.125 %		Bayer	18	65.1	190.1	27.2
Topsin 4.5 FL	30 fl oz		Cerexagri	6	31.1	72.8	29.7
Topsin 4.5 FL	20 + 20 fl oz	+ 12 Days	Cerexagri	7	176.8	488.7	26.4
Topsin 4.5 FL	40 fl oz		Cerexagri	8	166.2	442.3	31.4
Fenbuconazole 75 WSP	8 oz.		Dow	12	155.0	425.5	29.2
Omega 500 F	16 fl oz		Syngenta	9	162.6	392.5	26.9
V-10135 20 WDG	0.75 lb ai		Valent	10	131.6	333.9	22.1
V-10135 20 WDG	0.5 lb ai		Valent	11	157.4	444.7	30.4
LSD p=0.05					NS	NS	NS
% C.V.					102	97	15

[y] Yield visually adjusted for loss due to birds.

[z] Endura formulated as 70% WG.

Table 2. Disease Evaluations by Fungicide and Adjuvant Langdon, 2005.

Fungicide and Adjuvants	Trt. #	Disease Evaluations							
		Incidence (%)	Head Severity[z] (%)	Number of Heads-[plot] in Each Category (0-12.4%)	(12.5-24%)	(25-50%)	(50-99%)	(100%)	Uninfected Heads
Untreated	1	85	87.7	0.3	1.3	0.3	1.3	12.3	2.5
Endura+Interlock+AGF040023	4	72	76.0	0.0	2.0	0.8	1.5	8.5	4.8
Endura+Interlock+Preference	5	68	86.5	0.5	1.0	0.5	1.0	7.8	5.0
Endura+Interlock+Preference	19	87	88.9	0.3	1.0	0.5	1.3	12.0	2.3
Endura+Interlock+AG04050	20	83	89.1	0.5	0.8	0.5	1.0	12..3	3.0
Endura	13	83	86.5	0.5	0.5	1.0	1.5	11.0	2.5
Endura	14	79	94.6	0.0	0.3	0.8	0.5	12.3	3.3
Endura	15	78	85.5	0.3	1.5	0.8	0.5	11.0	4.0
Endura continuous coverage	16	83	86.7	0.5	0.8	0.5	0.5	9.3	3.3
Proline + NIS	2	81	84.1	0.5	1.0	0.5	1.8	11.3	3.3
Proline + NIS	3	86	88.9	0.3	1.3	0.3	0.8	13.3	2.8
Prosaro + NIS	17	72	89.2	0.0	0.5	0.8	1.3	10.3	4.8
Folicur + NIS	18	93	95.2	0.0	0.3	0.3	1.5	14.5	1.3
Topsin 4.5 FL	6	77	77.3	0.3	0.3	1.0	0.5	10.5	1.8
Topsin 4.5 FL	7	76	80.6	0.5	1.0	0.8	1.3	6.8	3.8
Topsin 4.5 FL	8	81	91.2	0.0	1.0	0.5	0.8	11.8	3.3
Fenbuconazole	12	84	86.8	0.3	1.0	0.3	1.5	11.0	3.0
Omega 500 F	9	71	78.2	0.3	0.3	0.8	0.8	9.8	3.0
V-10135 20 WDG	10	85	88.1	0.5	0.5	0.5	1.8	11.3	2.5
V-10135 20 WDG	11	86	82.4	0.5	0.8	1.3	2.0	9.8	2.3
LSD p=0.05		NS	NS	NS	NS	NS	NS	NS	NS
% C.V.		19	16	179	117	123	85	31	76

[z]Mean head severity calculated as number of heads of each category (((Cat1*0.0625)+(Cat2*0.1875)+(Cat3*0.375)+(Cat4*0.75)+(Cat5*1))/Incidence)*100